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Irrigation Management of Sunflowers

Sunflower is a crop that can be grown under irrigated or dryland conditions. There are two different types of sunflowers: the confectionery type which is used for human consumption and birdseed, and the oilseed type which is used to manufacture cooking oil and margarine.

In Alberta, most of the sunflowers grown on irrigated land is for confectionery use. Only a small acreage of sunflowers is seeded to oilseed type hybrids. When growing sunflowers for confectionery use, the aim is to find the optimum number of plants per acre, which may not appreciably affect yield, but will significantly increase seed size. Plant density should range from 18,000 to 22,000 plants per acre.

For oilseed production, the objective is to get maximum yield with no regard for seed size. Medium to high populations produce higher crop and oil yields than do low populations. Plant density should range from 22,000 to 26,000 plants per acre.

Optimum growth for sunflowers occurs when mean daily temperatures range from 18 to 25°C. Sunflowers have good frost tolerance up to the four-leaf stage.

Sunflowers have a low tolerance to soil salinity at all stages of growth.

Crop Water Requirements

In non-restrictive soils, sunflowers develop an active rooting zone of 1.0 m. The seeding date for sunflowers is between April 25 and May 7, with the growth period extending from May 10 to September 10. Sunflowers require 120 to 125 days to reach physiological maturity.

Sunflowers have a seasonal water requirement of 510 mm (20 in.) per year. During the vegetative stage of growth, water use varies from 1.0 to 2.5 mm/day (0.04 to 0.1 in.). As the crop enters into its flowering period, water use can increase to a high of 6.5 mm/day (0.26 in.) Over a 30-day period, maximum water use will average 6.0 mm/day (0.24 in.).

The recommended allowable depletion level for sunflowers is 50 per cent for the total root zone.

Sunflowers are relatively drought tolerant until heading. During dry periods in June, sunflower leaves often remain turgid in contrast to the rolling of corn leaves, suggesting that sunflowers in the pre-heading stage are more drought tolerant than in corn. In July at heading stage, sunflower leaves readily wilt in dry periods.

Irrigation from heading until near maturity (mid-July to mid to late August) almost always gives a large yield increase over dryland sunflowers. Furthermore, irrigation keeps the crop growing towards maturity. Under severe moisture stress, sunflower plants often loose their lower leaves, flower development stops, and the plants remain in a dormant state until soil moisture conditions improve. Drought caused delays in maturity can be very damaging where the growing season is short. Leaf loss at mid-anthesis stage can cause some serious yield and seed size reductions if adequate water is not available for plant use.

In addition to higher yields, seed from irrigated sunflowers is often higher in oil and larger than seed from dryland sunflowers. This is particularly important for confection sunflowers.

Crop water requirements of sunflowers are relatively high compared to most crops in respect to total yields. Water requirements depend on climate and length of total growing period. Evapotranspiration rates increase from establishment to flowering (See Figure 1).

High evapotranspiration rates are maintained during seed setting and early ripening. Percentage of total crop water use over the different growth periods is about 20 per cent during vegetative period, 55 per cent during the flowering period and the remaining 25 per cent during the yield formation and ripening periods. Despite its high water use, the crop has an ability to withstand short periods of severe soil water deficit.

However, long periods of severe soil water deficit at any growth period cause leaf drying with a subsequent reduction in seed yield. With heavy rain or irrigation following an extremely dry period, only a partial recovery occurs.

Water deficits during the early vegetative period result in reduced plant height but may increase root depth. Adequate water during the late vegetative period is required for proper bud development. The flowering period is the most sensitive to water deficit. Soil moisture stress at this time will cause considerable yield decrease since fewer flowers come to full development. In oilseed sunflowers, moisture stress during this period will result in a greater yield loss than stress at any other

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stage of growth. In confection sunflowers, seed size is much larger and, because a premium is usually paid for seed over a certain size, the critical growth period will be one or two weeks later than the critical growth period of oilseed sunflowers. Adequate soil moisture conditions need to be maintained not only during the flowering period but also through to the early filling of seeds. Limiting water at the early seed filling stage will also cause a reduction in both seed size and oil content.

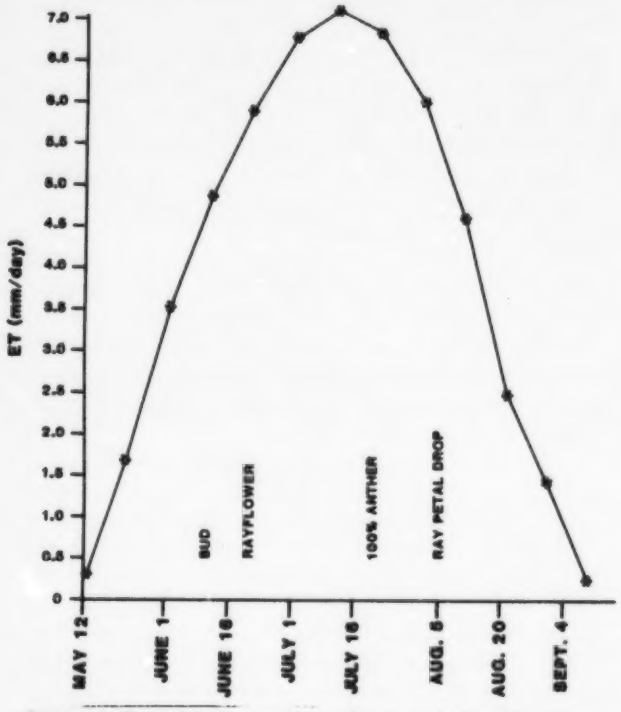

Figure 1. Crop water use of sunflowers during the growing season.

Total water use of a sunflower crop yielding 2500 to 3000 kg/ha would be approximately 500mm (20 in.) (See Figure 2). One-half to two-thirds of this amount would normally be supplied through irrigation. The last irrigation should be scheduled during the seed filling stage depending on the presence of disease.

Comments

Soil water depletion should not exceed 50 per cent of the available soil moisture, particularly during the late vegetative, flowering and yield formation periods.

If soil moisture is inadequate for proper seed germination, a light application of water (25 mm) should be applied. Applying a light amount of water will help to reduce the problems of leaching nutrients from the seed bed to lower depths in the root zone, soil crusting and lowering of soil temperatures.

Since sunflowers can only be irrigated effectively by centre pivots or surface irrigation methods, the timing and amount of water to be applied becomes important. Surface irrigation methods tend to apply more water than what the soil is capable of holding (water lost below the root zone) and irrigations tend to be limited because of system design or labor constraints. Centre pivots on the other hand are able to control the timing and application of water better but have a tendency to be unable to keep up to crop water demands. Whichever irrigation method is used, check soil moisture conditions after harvest to see if sufficient moisture is available for good seed germination and seedling growth. The soil should also be checked throughout the growing season to ensure adequate moisture is available for full crop development.

A common misconception is that sunflower crops use less moisture than corn crops, which is not true. Sunflowers require more water early in the growing season while corn is a large water user later in the crop growing season.

Irrigation Management Information

For further information regarding irrigation management of sunflowers, contact your nearest Irrigation Branch office. These offices are located at: Lethbridge, 381-5136; Vauxhall, 654-2161; Airdrie, 948-8511; Taber, 223-7908; Strathmore, 934-3356; Brooks, 361-1212; Bow Island, 545-2231; Medicine Hat, 529-3616. North of Calgary, contact the Airdrie office or your local district agriculturist for assistance.

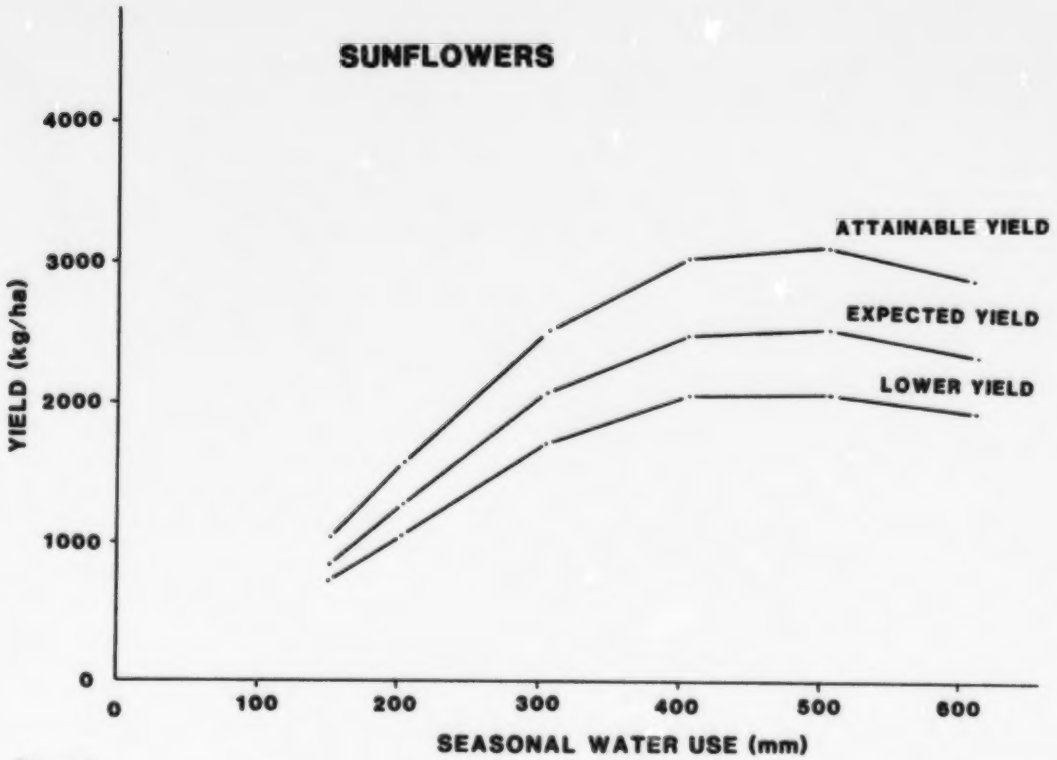

Figure 2.

Growing the development of sunflowers

GROWTH PERIODS	VEGETATIVE	BUD	FLOWERING	RIPENING
POST EMERGENCE DATES	40 - 45 DAYS	65 - 70 DAYS	90 - 100 DAYS	120 - 125 DAYS
CROP * ROOT DEPTH	2cm/DAY	2.5 cm/DAY	MINIMAL ROOT EXTENSION	
MOISTURE SENSITIVE PERIOD **				
AVERAGE E.T.	1.0 - 2.5mm/DAY	2.5 - 5.0mm/DAY	5.0 - 6.0mm/DAY	<6.5mm/DAY

* Maximum rooting depth will occur approximately by the time flowering begins.

** For optimum production, the first irrigation will be required before the crop enters into its water sensitive period.

The above times, depths and amounts are only average values for this particular crop. These values will change depending on the variety and area where this crop is grown.

Soil

Soils can vary greatly in texture from being very fine (clay) to very coarse (sand) within a crop root zone. Because soil texture can change quite quickly, so can the amount of water that the soil is able to hold.

Texture	Available Moisture
Loamy sand	8-12 mm/0.1m (0.9-1.4 in./ft)
Sand loam	10-15 mm/0.1m (1.2-1.8 in./ft)
Loam	14-18 mm/0.1m (1.7-2.1 in./ft)
Sand clay loam, clay loam, clay	15-20 mm/0.1m (1.8-2.4 in./ft)
Silty clay loam, silt loam	16-22 mm/0.1m (1.9-2.6 in./ft)

It is important to know and to be able to calculate the amount of moisture present in the soil root zone in order to understand the amount of moisture available for crop use. The allowable depletion level is the amount of soil moisture that can safely be removed from the root zone by a crop before an irrigation is required. For sunflowers, the allowable depletion level has been determined to be 50 per cent. The simplest way to determine soil moisture content is by the "feel" method. By feeling, squeezing and observing a handful of soil, one can determine the amount of moisture present in the soil. The following chart outlines the various characteristics of soil based on different contents of water.

		Feel or Appearance of Soils		
	PERCENT OF AVAILABLE MOISTURE REMAINING	MODERATELY COARSE TEXTURE	MEDIUM TEXTURE	MODERATELY FINE TEXTURE
DO NOT IRRIGATE	At field capacity 100	Upon squeezing no free water appears on soil but wet outline of ball is on left hand.	Same as sandy loam.	Same as sandy loam.
	75 to field capacity	Forms a weak ball, breaks easily, will not slide.	Forms a ball and is very pliable; slicks readily if relatively high in clay.	Easily ribbons out between fingers, has a slick feeling.
IRRIGATE SPEC. CROPS	50 to 75	Tends to ball under pressure but seldom will hold together	Forms a ball; somewhat plastic; will sometimes slick slightly with pressure	Forms a ball, will ribbon out between thumb and forefinger
IRRIGATE	25 to 50	Still appears to be dry, will not form ball with pressure.*	Somewhat crumbly but will hold together from pressure	Somewhat pliable, will ball under pressure
	0 to 25	Dry, loose, single-grained, flows through fingers.	Powdery, dry, sometimes slightly crusted but easily breaks down into powdery condition.	Hard, baked, cracked; sometimes has loose crumbs on surface

* Ball is formed by squeezing a handful of soil firmly.